c) disposing on the composite substrate a buffer layer having a buffer layer lattice constant substantially identical to the epilayer lattice constant, and

if the buffer layer lattice constant is greater than the composite lattice constant, then selecting the buffer layer wherein the buffer layer thermal expansion coefficient is greater than the composite thermal expansion coefficient, and

if the buffer layer lattice constant is smaller than the composite lattice constant, then selecting the buffer layer wherein the buffer layer thermal expansion coefficient is smaller than the composite thermal expansion coefficient; and

d) disposing the epilayer on the buffer layer.

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23.(New) The method according to claim 22, wherein the substrate comprises one or more substrates.

24. (New) The method according to claim 22, wherein the disposing of the buffer layer comprises:

growing the buffer layer on the composite substrate;

thermally annealing the buffer layer and composite substrate when the buffer layer reaches a thickness of a bending radius of at least a majority of threading dislocations present in the buffer layer; and

repeating the growing and thermally annealing steps until an aggregate buffer layer thickness is greater than the bending radius of substantially all threading dislocations present in the buffer layer.

25. (New) The method according to claim 22,wherein the buffer layer is grown on a first substrate layer.

26. (New) The method according to claim 22, wherein the buffer layer is grown on a second substrate layer.

27. (New) The method according to claim 22, wherein the disposing step of a first epilayer on the buffer layer comprises growing the first epilayer on the buffer layer.

28. (New) The method according to claim 27, further comprising the step of growing a second epilayer on the first epilayer.

29. (New) The method according to claim 22, wherein the first substrate layer is of a material selected from a group consisting of GaP, Si, and Ge.

30. (New) The method according to claim 29,wherein the second substrate layer is of a material selected from a group consisting of InP, Ge, and Si.

31. (New) The method according to claim 30,wherein the buffer layer is of a material selected from a group consisting of AlGaAs, InAlAs, and InGaAs.

32. (New) The method according to claim 31, wherein the first epilayer is of a material selected from a group consisting of AlInGaP and InP.

33. (New) A method for forming low defect density epitaxial layers on lattice-mismatched substrates, comprising the steps of:

a. selecting an epitaxial layer having an epilayer lattice constant and an epilayer thermal expansion coefficient;

b. forming a composite substrate having a greater composite thermal expansion coefficient than the epilayer thermal expansion coefficient if a composite lattice constant of the substrate is smaller than the epilayer lattice constant, or forming a composite substrate having a lower composite thermal expansion coefficient than the epilayer thermal

expansion coefficient if the composite lattice constant is greater than the epilayer lattice constant,

c. forming the composite substrate with a first substrate layer and a second substrate layer wherein a ratio of thickness of the first substrate layer to thickness of the second substrate layer is greater than one;

d. disposing on the composite substrate a buffer layer having a buffer layer lattice constant substantially identical to the epilayer lattice constant, and

if the buffer layer lattice constant is greater than the composite lattice constant, then selecting the buffer layer wherein the buffer layer thermal expansion coefficient is greater than the composite thermal expansion coefficient, and

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if the buffer layer lattice constant is smaller than the composite lattice constant, then selecting the buffer layer wherein the buffer layer thermal expansion coefficient is smaller than the composite thermal expansion coefficient; and

e. disposing the epilayer on the buffer layer.